DOCUMENT RESUME

ED 310 696 HE 022 803

AUTHOR Grassini, Norma; Benz, Linda
TITLE Partnerships between Higher Education and Industry/Business. An Annotated Bibliography.
INSTITUTION Southern Illinois Univ., Carbondale.
PUB DATE 89
NOTE 77p.
PUB TYPE Reference Materials - Bibliographies (131)

EDRS PRICE MF01/PC04 Plus Postage.
DESCRIPTORS *Access to Information; *Annotated Bibliographies; Corporate Support; *Economic Development; Higher Education; Human Resources; Industry; *Innovation; Research and Development; *School Business Relationship; Technological Advancement

ABSTRACT

Academic/industrial relationships are examined from the viewpoint of economic development and development through technological innovation. The annotated bibliography consists of four sections: general overview of higher education and industry linkages (linkages between higher education and industry regarding research and development, human resource, and entrepreneurial relationships); research and development relationships (relationships between higher education and industry); human resources relationships (training partnerships between higher education and industry); and entrepreneurial relationships (activities that higher education undertakes to assist industry in technological change). (SM)

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PARTNERSHIPS BETWEEN HIGHER EDUCATION AND INDUSTRY/BUSINESS

An Annotated Bibliography
by

Norma Grassini
and
Linda Benz

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at Carbondale

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INTRODUCTION

The attitude of universities toward technology is still ambiguous; until the ambiguity is resolved the universities will not have adapted themselves to one of the major consequences of the scientific revolution (Ashby 1958).

This report looks at academic/industrial relationships from the viewpoint of economic development or, more specifically, of development through technological innovation. Today's widespread interest in linkages between higher education and industry results from powerful pressures to strengthen the nation's technological capabilities in the face of worldwide economic competition. Numerous states have launched ambitious plans for technological development designed in part to forge a high-technology connection between higher education and industry in the areas of manpower training, research, and technology transfer.

Cooperation in research and development typically involves the leading research universities and the large corporations that undertake extensive research and development themselves. The long tradition of relationships between American universities and corporations, marked by periodic ups and downs, has recently taken on a new intensity, especially in fields of very rapid technological change. Among the incentives for stronger research ties are the universities' needs to augment federal funding and industry's needs to cope with increasing competition and maintain access to science-based technology. Several models of cooperation in research are common, ranging from short-term contracts involving one institution and one company to cooperative research centers that may involve multiple institutions, companies and purposes.

Cooperation in technology transfer is of interest to economic planners because of the view that advances in science and technology contribute to economic development only when they are used in the marketplace. Invention is but one part of the process of technological innovation. Several stages, considerable cost and risk, and countless factors affect its success. The circumstances of a particular community, an existing corporation, or a small business enterprise are all relevant to effective transfer, and they challenge academic institutions to work with other organizations in providing an array of services. In their most advanced form, the mechanisms used represent a cooperative approach to entrepreneurial development that goes far beyond transmittal of information.

Technological progress also depends on scientific and engineering manpower, training and retraining of the work force, and information on future occupational requirements. Collegiate and corporate organizations work together to address such needs through advisory structures, traditional and nontraditional programs, and other means. Thus, a conceptual framework for intersector relations must include the human resources dimension

along with research activities and entrepreneurial services to encompass all of the substantive areas of interaction. Such a framework should also indicate that cooperative models vary in the extent of interaction involved, some being merely industry oriented, others collaborative in nature, and still others representing full partnerships. A total perspective further recognizes that serious barriers to cooperation will be encountered and that fundamental policy issues will arise, the first reflecting the difficulties of interorganizational effort and the second, the inevitable tensions between the role of service and the principles of academic freedom, autonomy, and objectivity.

An annotated bibliography follows, which consists of four sections:

(1) **General overview of higher education and industry linkages.** This section reviews general linkages between higher education and industry regarding the three areas of connection: research and development, human resource, and entrepreneurial relationships.

(2) **Research and development relationships.** In this section, literature about the research and development partnerships between higher education and industry is reviewed.

(3) **Human resource relationships.** Here, the training partnerships between higher education and industry in order to keep employees' skills up-to-date, are discussed.

(4) **Entrepreneurial relationships.** This last section reviews bibliography about different activities that higher education undertakes in order to assist industry in technological change.

GENERAL OVERVIEW ABOUT HIGHER EDUCATION AND INDUSTRY LINKAGES

Cross, P. (1985). Education for the 21st century. (ERIC Reproduction Service No. ED 262 691).

Ways that higher education can best contribute to the quality of life in the 21st century are discussed.

While higher education is coping with anticipated lowered demand for traditional services, new educational functions are being assumed by corporations, professional associations, and other noncollegiate providers.

Industry provides continuing education for employees because they cannot find viable providers through academic sources. Colleges should be addressing whether and to what extent they wish to serve the industrial sector.

Colleges need to question their role (e.g. human development, intellectual growth, academic achievement, career development) and what population is served (e.g. age groups, employers).

Industry seems to have adopted the broadest possible goal for their education and training divisions: the development of human resources. The future will require a skilled, adaptable, and innovative labor force and a more flexible, less hierarchical organization of work.

Higher education needs to prepare students for active and continuous involvement in their own lifelong education. Students need cognitive skills, motivation, and self-direction.

Implications of the current information explosion and skills employers seek in graduates are also considered.

Currin, Earl C. Jr. & Sullins, W. Robert (1988). The community college's role in rural economic development. Community Junior College Quarterly 12, 37-46.

The authors discuss in this article the stated mission of community colleges, among an array of functions and activities, in economic development. It is pointed out that the significance of community colleges' involvement in economic development seems to be more prevalent in rural America.

Currin and Sullins conducted a research project to determine the extent to which small rural community colleges are involved in various economic development activities and the effectiveness of those activities. The survey instrument accessed was the adaptation of one used by Kingry (1984) to review the role of Oregon community colleges in economic development as members of the college community perceive them. Currin and Sullins requested 237 small rural college presidents in the Southeast to rate each of 25 activities as to the level of emphasis that was presently occurring at their institution and to assess the level of success for each activity. Of the 237 college presidents surveyed, 165 responded. The average frequency of involvement in economic development activities was 15.

The results of this study are outlined as follows and indicate responses of 80 percent of small rural college presidents in regards to the level of involvement in economic development by selected community colleges:

1. Provision of skill upgrade training exists for employed persons wanting to keep pace with changing technology or a desire to change positions;

2. Provision of training in basic and mid-level management skills;

3. Provision of short courses and workshops for company employees;

4. Community college staff serving on local community development councils.

In summary, Zeiss (1986) has made a few recommendations with regards to the position of community colleges in economic development. He stresses that their role should include the development of a small business assistance center, assistance in chamber of commerce activities, assistance in the visitation of teams looking for a relocation of their industry, customization of training programs specific to industry, and publicizing the college's role in these activities. Along these same lines of thinking, the authors recommend, as a result of their study, that small rural college leaders should continue their efforts to make local, state and national leaders aware of the importance that community colleges can play in economic development.

El-Khawas, E. (1985). Campuses Weld the Corporate Link. Educational Record, 66(2), 37-39.

A recent ACE survey shows evidence of growing corporate-college collaboration. It shows that a diverse array of linkages already exist, covering research, education, and other purposes. It also documents the substantial, parallel role that community colleges have played in working with local business, especially to meet their training needs.

Link 1: Exploring concerns

The development of sophisticated agreements between business and higher education have their beginnings in more limited forms of cooperation. The most prevalent link is through advisory panels and the conduct of meetings designated to explore mutual concerns.

Link 2: Assisting students

Another traditional form of partnership involves corporate support of loan and scholarship programs for students. Corporations help with scholarships and loans more often in the technical fields of study.

Link 3: Supporting research

Corporate support of university research continues to be strong. There is evidence of creative efforts to forge new forms of cooperation as well.

One trend has been toward pooling of resources. Shared facilities offers a way for both colleges and employers to ensure that campus research is up-to-date and students receive training in the best available setting. The pooling of resources has involved both equipment and facilities as well as personnel exchanges.

Link 4: Training employees

The ACE survey shows that as of 1984, close to half of America's colleges offer courses in business settings. This is true for both non-credit and for-credit courses. This reflects the strong presence of university continuing education programs in activities to provide educational opportunities to working adults.

Link 5: Joint programs

Substantial interest exists among colleges in conducting degree programs that are jointly developed and sponsored with corporations.

Joint degree programs (which probably include certificate programs at community colleges) may well signify the development

of "shared authority and dialogue" that Lynton has called a desirable component of corporate-college partnerships (El-Khawas, 1985).

The ACE survey shows that corporate reliance on colleges for training needs is already substantial and may be growing.

The outlook

There are indications that partnerships will involve a wider variety of academic institutions. Four-year institutions are rapidly increasing their capacity to respond to industry needs.

Powers, D., Powers, M., Betz, F., & Aslanian, C. (1988). Higher Education in Partnership with Industry. San Francisco, London: Jossey-Bass Publishers.

PART ONE

MAKING PARTNERSHIPS WORK: OBJECTIVES, APPROACHES, AND STRATEGIES.

1-Benefits of cooperation between Higher Education and Industry.

Academia and Business are unlikely partners. One difference lies in their attitudes toward discovery of knowledge.

Brown pointed out (1985)"There is an emerging recognition that, to maintain technological superiority in the long run, it is essential to make substantial investment in the basic research that will support the next generation technology...It is indeed this factor more than any other that will provide the rationale for more extensive industrial sponsorship of university research."

A- Higher Education's role in Economic Development.

Broadly, economic development is a process of innovation that increases the capacity of individuals and organizations to produce goods and services and thereby, create wealth. This definition has been offered by SRI International (1986).

Higher Education's role would be extremely important if it helped existing businesses adapt successfully to various conditions and factors characteristic of the changing economy, or if it can promote, directly or indirectly, development of new businesses that have a fair chance of succeeding in the modern marketplace.

(a) Promoting business development: In general terms, business development depends on availability of such factors as:

- Natural resources.
- Raw and processed material.
- Energy.
- Capital (at acceptable rates).
- Trained manpower.
- Competitive wage scales.
- Transformation systems.
- Supplies.
- Acceptable state labor hours.
- Markets.
- Competitive products or services to be marketed.
- Entrepreneurial skills.
- Competitive manufacturing systems.
- Leadership.
- Acceptable tax climate.
- Competitive delivery systems.

Investing in education is a common mechanism for improving the business climate of a region. The services that educational institutions provide can directly affect such factors as availability of trained manpower and can directly or indirectly affect such factors as availability of competitive products or services to be marketed, leadership, and entrepreneurial skills. Availability of other factors including processed material, competitive manufacturing systems, or delivery systems for services, also may be affected by processes or systems discovered or applied by academicians.

The Office of Technology Assessment, or OTA (1984), investigated a number of high-technology developments across the country: Emphasis of the resulting initiatives fall into six general categories:

- research, development, and technology.
- human capital.
- entrepreneurship training and assistance.
- financial capital.
- physical capital.
- information gathering and dissemination.

Clearly, higher education can be an effective mechanism through which at least some of these initiatives can be undertaken, in support of high-technology as well as other kinds of industries.

(b) Assisting existing companies: Research programs are expensive and can be an exception to this generality. If research is necessary to devise new or improved products or processes to revitalize an industry, a state may find, however, that the most economical way to subsidize this research is through a state university.

Colleges and universities also can be of assistance to companies throughout the business world in manufacturing industries, service-based industries, and information-based industries that must become computerized to remain competitive in a technological oriented economy.

In offering services to businesses, colleges and universities should not ignore small businesses. To help a small business, a university does not need a research mission. Often what is needed is advice in marketing plans, service-delivery systems, and bookkeeping. Nurturing new businesses by providing them with space and services at low costs has been undertaken by some educational institutions, usually business 'incubators'.

(c) Categories of Higher Education services for promoting Economic Development.

1- Basic and applied research: Fundamental discoveries by faculty members can lay the groundwork for new applications of technology, which in turn, can lead to development of marketable

products. Nowadays, faculty members are not only involved in basic research but also on applied research as well.

2- Technological assistance and advice on updating operations: Faculty members (often through consulting contracts) can help businesses determine which new technologies, processes or practices can be appropriate to their particular production, service-delivery, or management situations; whether the proposed changes can be initiated cost effectively; and to what extent such innovations can make the companies more productive and competitive. Advice on how to update operations of companies can focus on improving management techniques, service-delivery systems, production systems and processes, quality control, or product design.

Education and training programs: Every kind of college or university is involved, with universities and 4-year colleges, for the most part, providing training and updating for professionals and workers skilled in the more complicated or advanced aspects of the new technologies, and with community colleges providing training and updating for technical workers.

B- Advantages of cooperation relationships for organizations.

Reasons why Education seeks cooperative relationships with Businesses.

(a) To improve education's financial situation: Federal funds available to universities has declined in absolute terms.

(b) To improve advancement of knowledge by improving quality of instruction and research: Having corporate support, universities could improve in research and development, consulting, and training programs which could be more finely tuned to meet current corporate needs.

(c) To increase number of graduates in high-demand fields such as computer science, physics, engineering and mathematics: Scientists and engineers are offered better salaries by corporations than by universities. In this way, the number of faculty and researchers is diminished. Corporations could help by allowing their researchers and staff to become adjunct faculty members.

Reasons why Corporations seek cooperative relationships with Higher Education.

(a) To make a profit, corporations must seek new products, improve current products, make technological advances in production techniques, package and deliver services more effectively and efficiently, and optimize management. Universities conduct research in fields pertinent to these matters and employ faculty members who can provide expert advice.

(b) To gain access to personnel in fields where talent is rare, such as certain specialties in computer science and

engineering.

(c) To upgrade the professional development of corporate employees, sometimes through creation of ongoing, comprehensive employee training.

(d) To ease research and development investment. Universities often possess ample physical plants, built at state expense and maintained by taxpayers.

(e) Corporations can take full advantage of federally sponsored research. Laws passed in recent years empowered universities to seek patents on technologies or concepts growing out of federally sponsored research and to sell rights on such patents.

(f) Corporations can keep research cost effective. Contracting for external research to meet intermittent needs, speed research on particular problems, or confirm research results can be cost effective.

2- Cooperative approaches to Education and Research.

The Business-Higher Education Forum (1984) listed thirteen traditional types of business-higher education relationships:

- Corporate financial support of colleges and universities.
- Corporate financial support of students.
- Cooperative education.
- Corporate associate and affiliate programs.
- Research agreements-bilateral and consortial.
- Training programs.
- Personnel exchanges-internships and sabbatical.
- Conferences, colloquia, and symposia.
- Consultancies, lectureships, directorships, and advisory services.
- Corporate access to university resources.
- Corporate recruiting of students.
- Joint projects to address national problems.

Smith, H. (1988). Business Sense. In Currents, 14(3), 6-10.

CORPORATE SUPPORT ON EDUCATION

The specific rationale upon which businesses justify their investment in higher education is based on the fact that they rely on colleges and universities for:

(1) newly trained employees in the professional, technical, and managerial disciplines that are necessary to business growth

(2) the basic research that leads to increased knowledge and fosters new materials, processes and products

(3) many of the public services so vital to the communities where corporations have offices, plants, warehouses, and other facilities

(4) all that higher education contributes to the overall quality of life, including the health of the economy and society

CAMPUS-CORPORATE LINKS: AN ACTION AGENDA

Hayden Smith wrote in a 1983 report on cooperation between the corporate world and colleges and universities the general types of corporate-campus partnerships:

(1) Corporate financial support of colleges and universities
(2) Corporate financial support of students
(3) Corporate education
(4) Corporate associate and affiliated programs
(5) Research agreements
(6) Training programs
(7) Conferences, colloquia, and symposia
(8) Consultancies, lectureships, and faculty loans
(9) Personnel exchanges
(10) Volunteer programs
(11) Corporate access to the university
(12) Corporate recruiting of students
(13) Joint projects to address national problems
(14) Unconventional corporate support of higher education

LOOKING AHEAD

Growth in corporate support of education will continue and even accelerate slowly.

One reason for this is the trend toward closer corporate-campus cooperation. This cooperation is growing in scope and intensity and the search continues for new kinds of relationships.

Western Technical Manpower Council of the Western Interstate Commission for Higher Education. (1983). High-technology manpower in the west: strategies for action. Boulder, Colorado: WICHE.

The following will review the work and recommendations of the Western Technical Manpower Council as they assisted policy makers (in state government, industry, education and professional and regional organizations) in the western states to examine crucial issues involving high technology manpower. The Council's publication pointed out that the western states are an important force in the nation's high-technology industries. The work of this manpower council is reviewed below and written in the form of recommendations or strategies of action.

One of the recommendations proposed by the manpower council is to build a statewide and interstate system of manpower planning that focuses on coordination of information between education institutions, industry and government. Universities are considered to be a critical element in high technology developments. Better long-range planning by industry, government, and education is essential to keep up with the fluctuations in the supply and demand of high-technology manpower.

Secondly, effective use of advisory councils composed of industry and educational representatives to review the design and delivery systems of education programs at 2, 4-year and graduate level schools, keeping in mind industry needs and quality, is of the utmost importance. Most community colleges have such advisory councils which are composed of representatives from local businesses and industry. These councils keep community college administrators informed on labor market trends and of the changes in the work force itself so that curricula can be altered in direct response to industry's needs.

In addition, industry and universities have established numerous joint research centers in the last decade. Five corporations have joined Purdue University to create a research center that will develop prototypes for a computerized factory of the future. Stanford University's Center for Very Large Scale Integration Systems research involves several companies in joint research and development efforts of new products and research, and continuing education is provided to graduates and other professionals through instructional television and videotape courses.

A third recommendation of the council is to establish shared laboratory facilities between industry and postsecondary educational institutions wherein states and industry share the costs for maintaining top-quality equipment and facilities located in regional centers. The University of Utah Research Park provides a site for industry/education resource sharing. Industries located at the park receive technical assistance from faculty and in exchange faculty have an opportunity to undertake

research and access state-of-the art equipment in industry laboratories.

Lastly, a clearinghouse on a statewide or regional level is recommended in order to identify equipment available within industry and identify equipment needs of educational institutions for a more effective match of equipment donations. A clearinghouse would aid campuses in identifying specific equipment available at companies and aid companies in identifying where donations to campuses would be invaluable.

RESEARCH AND DEVELOPMENT RELATIONSHIPS

Johnson, L. (1984). The High-Technology Connection: Academic/ Industrial Cooperation for Economic Growth. ASHE-ERIC Higher Education Research Report No. 6. Washington, D.C.: Association for the Study of Higher Education.

The purpose of this report is to examine the high-technology connection in which academic institutions and industrial firms are joined in cooperative efforts to simulate technological change, taking into consideration the major spheres of academic/industrial cooperation, the primary mechanisms of interaction, and some of the most emerging problems and opportunities.

What makes up the "High-Technology Connection?"

From the standpoint of economic development, the high-technology connection can be conceptualized in terms of three major areas of linkage: research and development, technology transfer, and human resource development. The research and development connection is discussed here.

Research and Development connection: This connection occurs through research centers and institutes, industry-sponsored contract research, special university/industry research agreements, personnel exchange programs, research consortia, and cooperative research centers.

(1) Research centers and institutes: Over 5,000 research centers are operating in colleges and universities, many of them for the application of academic research to the problems of industry or other sectors of the society (Shapero, 1979).

They may be located within a department or school, or affiliated with the institution but organized as a separate unit. External funding is common, such as a mix of government, foundations, and industrial funding as well as support from the institution. At many institutions, a major share of industrial support is channeled through research centers (Finkbeiner, 1969).

Research centers may focus on regional needs or the needs of specific industries. These centers conduct basic research, disseminate information to industry, train graduate students, offer seminars, and test new products.

As organizational entities, they have their problems. Their staff may or may not have regular academic status, and their dependence on external funding requires the director of the center a big effort for promotion. They may lose touch with the institution's departments, so ties between the academic mainstream and the industrial community may be diminished.

(2) Industry-sponsored contract research: Over 50 percent of industrially supported research in universities is funded through the mechanism of contract research (Peters and Fusfeld, 1983).

Corporations look at academic institutions for research under contract when a gap exists in corporate knowledge of a specific area, or when an institution owns sophisticated instrumentation not otherwise available to the firm, or when evaluation is required of materials the company has developed (Brodsky, Kaufman, and Tooker, 1980).

Research contracts constitutes a vigorous interaction between academic and industrial personnel. It meets an important "market test" because it depends on the perceived value to the sponsoring firm of the resulting specific research findings and information (Baer, 1980).

(3) Personnel exchange programs: Personal interaction between representatives of industry and representatives of academia occurs to various degrees in all cooperative research.

Academic associations, foundations, and corporations have sponsored formal arrangements enabling academic and industrial scientists to spend periods of time in laboratories operated by their opposite numbers.

Some way of collaboration is to form teams of corporate and collegiate researchers to survey the needs and opportunities for new technology in selected industries (Stever, 1972) or to convene joint meetings between corporate research managers and selected academic departments to acquaint faculty with current corporate needs (White, 1973).

(4) Research consortia: Although research consortium is defined as "single university-multiple companies" collaboration mode,. it can also involve multiple institutions and multiple companies, or multiple institutions and a collective industrial research association.

In addition to involving multiple organizations in cross-sector cooperation, consortia typically focus on university-based research of generic interest to an industry, often assess membership fees to participating companies, and share research results among participants (Prager and Ommen, 1980).

Although the level of interaction may be less intensive than in other forms of research cooperation (Roy, 1972), research consortia shows a substantial amount of mutual involvement in planning and implementing research activities.

(5) Research centers: Cooperative research centers can be described as multiorganizational, multipurpose, and jointly planned and/or managed endeavor focusing on research and related activities of mutual interest.

Quite recently a number of state governments have considered research centers as advanced technology application programs. These programs focus resources on leading scientific and engineering centers where advanced research and training is

taking place that is of interest to the microelectronics industry. Sources of funding for these cooperative programs represent a mix of governmental and industrial support.

The success of these cooperative research centers requires strong research capabilities within the institutions, and interest in and commitment to working on large-scale programs of importance to industry, and strong leadership in the management of the centers (Tornatzky, 1982).

Milligan, F. (1988). The vital role of faculty in developing successful relationships with business and industry. (ERIC Reproduction Service No. ED 293 608).

Community college faculty play a vital role in establishment and continuation of industry training programs. Faculty assist the company in:

(1) determining the level, focus, and starting point of the course or program;

(2) developing instructional materials and techniques;

(3) present the subject; and

(4) interact with employee-student.

During the delivery of the course or program, they must demonstrate their expertise and the worth of the institution.

The faculty member who teaches partnership courses must:

(a) have a sense of entrepreneurship and corporate culture,

(b) be flexible, responsive, personable, and realistic teacher,

(c) be well versed in both theory and workforce applications of that theory,

(d) be able to adapt his/her instructional methods to mature students with varying educational backgrounds and immediate educational needs.

Recruiting and maintaining the interest of such faculty members is facilitated by the sense of novelty and challenge afforded by the change in setting and clientele, the ability to use the latest equipment, access to the firm's internal training classes, and additional income.

Some practical problems may result from the partnership programs, including conflicts between the firms and academic departments over teacher selection, scheduling problems, the lack of experienced instructors, and the lack of polices on workload and compensation.

Faculty excellence is the key to resolving these problems and providing successful training programs.

Powers, D. Powers, M. Betz, F., & Aslanian, C. (1988). Higher education in partnership with industry. San Francisco, London: Jossey-Bass Publishers.

PART ONE

MAKING PARTNERSHIPS WORK: OBJECTIVES, APPROACHES, AND STRATEGIES.

The two key types of programs that are the basis for business-higher education partnerships are: cooperative education and training programs and cooperative research programs. This chapter discusses the cooperative research programs.

Cooperative Research Programs.

Research is considered a fundamental stimulus to economic development and one of the crucial factors that allows the United States to remain a world leader, politically and economically.

Kinds of research partnerships: The range of higher education-business research and development partnerships is very diverse. Although universities tend to do basic research that advances science, and industries tend to lead in technological advances and their applications in products, in some large universities and businesses the entire spectrum of activity occurs. Physical and financial arrangements between cooperating organizations vary widely. Facilities and personnel connected to cooperative projects may be located at industrial plants, research parks, or hospitals, as well as on college campuses. Arrangements allowing researchers to switch roles with researchers from cooperating organizations, perhaps spending summers in each other's laboratories, facilitate collaborative research and development of products. Other low-cost exchanges may involve paying modest fees to consulting faculty members or adjunct professors drawn from corporate ranks.

Joint research programs involve long term collaboration between one or more industries and one or more universities, which share the cost of researchers and laboratories.

States also have been making contributions to establish technology centers designed to focus on specific problems in cooperation with industry.

Importance of promoting cooperative research: One challenge to continued economic development is the need for technology transfer. It is not enough the basic research be undertaken and that it generate knowledge. Information must be put into marketable form if it is to affect the economy. Changes in federal laws have been made to encourage such transfers.

Not only financing university-based research can ensure that technology transfer occurs, but also other factors such as processes of information dissemination, invention of applications, entrepreneurship, and capitalization are involved.

Another point to consider is the fact that although funds for research may be contributed by businesses in huge amounts, effects of such contracts and grants within the college-university community are concentrated in relatively few institutions, only those which are prestigious.

Powers, D. Powers, M. Betz, F., & Aslanian, C. (1988). Higher education in partnership with industry. San Francisco, London: Jossey-Bass Publishers.

PART THREE: PARTNERSHIPS FOR RESEARCH: LESSONS FROM EXPERIENCE.

The Nature of cooperative research: Reaching agreement on process, uses, and ownership.

A central question concerning university-industry partnerships is: What kind of research (basic, applied or developmental) may properly be undertaken through such projects? Inherent in the question is a challenge to the mission of the modern university, dedicated to education, research, and service. Traditionally, university-based research has been undertaken to advance basic knowledge. In extending the university's service mission to encompass applied or even developmental research undertaken for business, will not differences in the research cultures involved inevitably have considerable effect on the broad range of related university traditions, including such fundamentals as academic freedom? This concern was on the minds of National Science Foundation officials who administered the Industry/University Cooperative Research Program.

Universities and industries can find areas of mutual research interest in the fields of science and engineering that underpin current or future technologies. University and industrial researchers can cooperate in research most effectively by providing complementary skills and facilities for the conception and performance of research that neither group could realistically perform independently.

The value to industry of cooperative research with university lies in advancing knowledge of phenomena undergirding technology, improving principles for technological design, creating new research instrumentation, and creating new technologies. Industry is interested in performing fundamental research cooperatively with universities as a means of extending its basic research capability in parallel with its primary applied and developmental research capabilities that are focused on future technologies. Industrial managers rely on cooperative fundamental research to produce theories, data, instrumentation, and ideas to improve their propietary research and design programs.

Overall, the objectives in developing linkages between universities and industrial firms should be to improve the universities' contributions to national and regional economic development:

1- by facilitating transfer of problems and knowledge between the scientific and technological sectors of the nation.

2- by improving university training of industrial personnel

for technological innovation.

3- by effectively focusing national research resources upon technological advance and facilitating technology transfer from university research.

In the 1980s, research interactions of increasing numbers, depth, scope, and duration between universities and industrial firms became the most significant trend in the science and technology policy of the United States. Although there has been a history of relationships between universities and industrial firms, the significance of research cooperation in planning the long-term technical future of industries has become more important than in the past. Many contemporary observers noted this trend. For example, in 1986 Erich Bloch, the director of the National Science Foundation, wrote: "One of the most exciting and interesting developments in the world of R & D in the U.S. is the rapid growth of research relationships between industrial corporations and the nation's universities" (Bloch and Kruytbosch, 1986).

Both intellectual and organizational leadership are essential to the success of a cooperative center and must be provided by the director. Intellectual leadership should provide a strong grasp of technological problems and the various scientific approaches that may illuminate these problems. Organizational leadership is needed to create academic research teams, to communicate with industrial advisers and sponsors, and to keep projects focused. Participation in the management of a cooperative center by industry sponsors is vitally important, particularly when definition of research areas and selection and review of research projects are involved. In addition, researchers by industrial sponsors should be encouraged to participate in performance of some of the projects. Certain cultural differences are apparent between academic and industrial researchers; for example, academics tend to emphasize advancement of fundamental knowledge and tend not to work in teams, whereas industrial researchers tend to emphasize advancement of technology and tend to work in teams. Industrial participation in management of the center brings into the academic culture two important elements: a technological focus for integrating multidisciplinary research and encouragement of the teamwork necessary for academia to conduct multidisciplinary research.

In summary, university research that is cooperatively conducted should be organized so that it is basic but relevant to technology and supportable by industry:

1- Research should be basic in science, generic in technology, multidisciplinary in breadth, and have an industrial focus.

2- The director of a center should provide both intellectual and organizational leadership.

3- Industrial participants should be involved both in supporting and managing the center.

4- The university's administration should be supportive of multidisciplinary activity.

5- Federal support of basic research in the center should be structured to encourage university-industry interaction.

Schneiderman, Howard A. (1987). Making partnerships work. Across the Board, 24(5), 28-29.

The author, Howard Schneiderman, is senior vice president of research and development for the Monsanto Company. He has documented in this article his views, from personal experience, about what makes partnerships between industry and education work.

Monsanto spends between $15 million and $20 million per year on university research collaboration. Why would they not hire 150 additional in-house scientists instead? (Schneiderman, 1987, p. 28) The answer is that Monsanto's partnership with a university can aid an ever increasing research-intensive industry to secure resources that might not be available to a single industrial laboratory.

Schneiderman comments on several points that are musts in order to make partnerships work, and they are as follows. He has discovered that these points have made Monsanto's relationship with various educational institutions a successful relationship. They are:

1. In order for an arrangement such as the one described above to work, there needs to be clearly defined needs and expectations in writing at the outset.

2. There should be a social contract, confirmed by a written contract.

3. Identify a key individual with required authority as a company representative, key contact and problem solver.

4. Designate top company employees for active collaboration with university principal employees. The identification of these individuals will depend on the areas of investigation and collaboration.

5. Promote a spirit of give and take and openness in understanding among all participants.

Mr. Schneiderman remarks that the remembrance and practice of these key points will create a successful partnership between an industry/business and an educational institution.

Schoen, J. & Warner, S. (1983). A case study of qualitative research: Methods and administrative impact. AIR annual forum paper. (ERIC Reproduction Service No. ED 232 603).

A case study in program evaluation that demonstrates the effectiveness of qualitative research methods is presented. Over a 5-year period, the Union for Experimenting Colleges and Universities in Ohio offered a baccalaureate program (University without walls) to local employees of a national manufacturing firm.

The institutional research office evaluated the impact of the degree program on graduates and employers.

The academic programs were individually designed, monitored and executed using institutional and business resources and stressed job relevance and acquisition of job-related skills in the context of a liberal arts education.

The research office examined students files and individual portfolios, developed and administered a questionnaire, and interviewed graduates, their supervisors, and resource faculty within the firm.

Qualitative methods appeared to be appropriate for this study. Administrative outcomes included generation of material that increased visibility within the organization and that related directly to student recruitment.

Additional program outcomes include the following:

(a) the degree has provided career growth for a majority of graduates;

(b) students increased skills, knowledge and self-confidence; and

(c) students attitudes or performance on the job also improved.

Sheppard, R. (1986). Research and development and the role of the urban university in strategic economic planning. (ERIC Reproduction Service No. ED 277 799).

Urban universities have a definite role to play within the context of strategic economic development. Coordination between state and local government, the private sector, and the academic community can lead to effective partnerships to formulate and implement economic development plans.

Declining university enrollments and fewer dollars available for industrial research and development encourage collaboration, whereby the university shapes technology strategy more toward near-term applications, and the industrial sector transfers the technology being issued into the manufacturing environment to enhance competitive capabilities.

The University of Toledo's partnership with Northwest Ohio industry serves as an example of such a partnership. This consortium was the recipient of a Thomas Edison Grant for the purpose of establishing a stand-alone corporation with emphasis on the development of advanced manufacturing technology and sophisticated training programs for employees and management highly automated manufacturing environments.

The goal of economic development coordinators should be to ensure that the academic components play a key role in industrial and regional economic revitalization.

The Business-Higher Education Forum. American Council on Education. (1985). Educational Record, 66(3), 49.

A common agenda for the new term

The corporate and academic communities have unified around a common set of basic principles and goals.

Overall, their common agenda is geared to improving the nation's industrial competitiveness through the instruction of its colleges and universities, its industrial and academic research facilities, and its manufacturing plans. Within that general framework, which recognizes and tries to take advantage of the close links between academic scholarship and commercial innovation, a number of specific priorities have emerged. Together, these items make up the common business-higher education agenda.

Supporting economic growth

A skilled and educated work force, a steady flow of innovative products and processes, and state-of-the-art manufacturing facilities must be the keystones of America's global competitiveness in the coming years.

Both sectors, business and university, have argued that policymakers should preserve the 25 percent R&D investment tax credit and should make a major effort to finance the massive rebuilding (at an estimated $50-60 billion cost) of American university laboratories, research facilities, and other buildings.

Encouraging innovation

Educators and business executives jointly have called on lawmakers to continue productive initiatives to enhance education and technological innovation.

In the area of education, the academic and business communities have called on the Administration and Congress to reverse a decade-long decline in the funding of critical teaching- and research-related programs. They have solicited direct funding and/or tax incentives for the extensive rehabilitation of university laboratories and research facilities.

The initiatives' common goal is to facilitate the successful application of basic American research to American economic development.

HUMAN DEVELOPMENT RELATIONSHIPS

Adams, P., & Others. (1987). Basic skills competencies for career enhancement. Procedural guide. Curriculum, lesson plans, and marketing brochure for model on site ABE classes in government and industry. Final report and final products for ABE 310 project 40272. Seattle, Washington: North Seattle Community College. (ERIC Reproduction Service No. ED 290 849).

This document describes a demonstration pilot project that brought Washington's North Seattle Community College (NSCC) instructors together with the staff training office of the City of Seattle. With 310 grant, the NSCC Adult Education Division offered a successful basic skills course on-site for City of Seattle employees.

The procedural guide included in this document shows the steps NSCC adult education instructors took to identify and assess trainees' skill levels, to learn supervisory expectations of the training, to familiarize themselves with reading and writing tasks and materials the trainees have to use on the job, and to compile lists of competencies identified by supervisors and teachers. The guide also shows steps taken to recruit, market, test, and evaluate the program.

The second part of this document is a competency-based program of instruction in basic skills that include the syllabus, pretests and posttests, assignments, lesson plans, competencies, and job-related materials for the reading and writing and test-taking class at the City of Seattle.

The final product included in this project is a marketing brochure that the Adult Education Division will use with other companies and agencies to promote in-house training in basic skills.

Anderson, R. (1987). Industry/University continuing education: from co-existence to collaboration and competition. Engineering Education, 77(7-8), 674-77.

This article argues that while industry-supplied and university-supplied continuing technical education and training have peacefully coexisted for the past few decades, in the future industry and university will greatly increase both their collaboration and their competition. It is not clear now whether the collaborative or the competitive character of this relationship will dominate.

FACTORS FORCING EMPLOYERS TO TAKE MORE RESPONSIBILITY

The rapid rate of change and the fierce competition among companies have led to widespread recognition that the knowledge and skills of employees are the most critical resource of an organization. Managers now are focusing increasing time and energy on employee education and training.

THE MOVE TOWARD COLLABORATION AND COMPETITION

So now we see employers with increased interest and concern about the continuing technical education and training of their employees, and we see universities with more interest in providing those employees with both education and training. The combination of these two movements will lead to both increased collaboration and to increased competition between industry-supplied and university-supplied continuing technical education and training for employees.

TENDENCIES TOWARD COLLABORATION

Below is an assessment of five "musts" that have to be accomplished if industries and universities are to collaborate on supplying continuing education and training to employees.

(1) Industry must both identify and assign priorities to its education and training needs.

(2) The content of the collaborative industry-university education and training programs must be more oriented toward fundamentals and less toward both applications and company-specific situations.

(3) The university must propose programs that minimize employee learning time.

(4) The university must propose programs that are priced competitively when compared with both the option of the company's doing the programs with internal staff and of the company contracting a for-profit training provider.

(5) The university must propose a schedule for the design, development, and delivery of the education and training program

that is short and comparable to schedules proposed by both the internal training staff and the for-profit training company.

Other forces that lead industry and university toward collaboration include industry's desire to develop and maintain good relationships with one or more universities, industry's current tendency to find suppliers for goods and services that are not considered essential to the mainstream of the company, and industry managers' current lack of awareness of alternatives to university programs.

TENDENCIES TOWARD COMPETITION

Managers in industry know that the largest elements in the cost of employee training are the wages and benefits paid to employees while they are learning (and not working). If universities are not willing to provide programs that make efficient use of the learner's time, industry will create and deliver the required programs even when the needed content is more fundamental and even if the cost is higher than the university's proposed cost. By minimizing learning time, industry can minimize its total cost for the program.

In addition, industry wants programs designed and developed as quickly as possible, regardless of the time of year. Frequently universities cannot respond quickly to industry requirements because of the on-campus instructional responsibilities that occupy their staff during the traditional academic year.

If universities do not meet industry's requirements, then internal training staff will grow to meet internal needs or external for-profit companies will develop.

Brown, S. (1984). The influence of cooperative education on first job after college. Boston, Mass.: Northwestern University, Center for Cooperative Education. (ERIC Reproduction Service No. ED 254 663).

A study investigated whether graduates of cooperative education programs, especially those who remain with a former co-op employer, report a greater sense of power in their jobs than new college hires.

Two mechanisms by which cooperative education might lead to this outcome were hypothesized: better organizational socialization and greater perceived relevance of job to career plans.

The population studied was college graduates working their first full-time job since graduation. Data were obtained by mailed questionnaire from 225 employees. Results show that cooperative education graduates have more realistic expectations regarding their first job after college than do graduates of typical degree programs.

Such expectations, which provide evidence of successful early socialization to the company, were also predictive of an important outcome of socialization-commitment to the employing organization.

More co-op graduates were concerned about and chose jobs relevant to their career plans. Although co-op status itself was not a significant predictor of employee sense of power, organizational commitment and job relevance were.

Data showed that cooperative educational experience facilitated the transition from student to employee.

Included are correspondence, instrument, and data.

Clagett, C. (1988). Prince George's County business training needs assessment. ENSCAN88: Market analysis report MA88-4. Prince George's Community College, Office of Institutional Research and Analysis. (ERIC Reproduction Service No.ED 293 590).

A collaborative study was conducted by representatives of the Prince Geroge's Chamber of Commerce, the University of Maryland University College, and the Prince George's Community College to identify the training and professional development activities most desired by county business leaders.

Surveys were mailed to 5,000 of the 15,125 businesses located in the county, requesting information on the types of management and employee development training most needed, the businesses' present involvement in formal training programs, the preferred format for training, and ways in which educational institutions could promote business success in the county.

Study findings based on responses from 182 businesses, included the following:

(1) nearly 60% of the responding firms indicated that their employees had participated in some form of formal education or training within the last year.

(2) although 37% of the respondents had formal in-house training programs, 60% indicated a willingness to financially support employee professional development.

(3) employees' skills most in need to improve were oral communication, interpersonal relations, and writing, with a majority of respondents indicating a strong need for training in each of these areas.

(4) the most favored format for training was open-enrollment courses offered weekday evenings at colleges campuses or centers.

Gainous, F., & Others. (1987). Kansas community college business/industry relationships report, 1985-86 school year. Topeka: Kansas State Dept. of Education. (ERIC Reproduction Service No. ED 276 485).

Statewide data were gathered to determine the extent of relationship between business and industry and Kansas community college's system during the 1985-86 school year.

Analysis of the data indicated that:

(1) the community college system served 20,175 employees of 425 businesses in the state with 731 courses and 351 non-credit services offered through 40 major educational programs.

(2) on the average, each college served 1,120.8 employees of 22.4 businesses with 43 courses and 19.5 non-credit services.

(3) the number of businesses served by the colleges ranged from a low of 2 companies to a high of 82 firms.

(4) each of the colleges generated at least 22 credit hours by serving business/industry, while one college generated 3,378.5 credit hours by doing so.

(5) six of the colleges offered no non-credit services, while one institution offered 99 non-credit services.

(6) three schools served 41.6% of all business/industry.

(7) the most significant educational programs in terms of number of businesses served were allied health, business, and management, which accounted for 48% of the businesses and over 31% of the employees served by the state system.

The bulk of the report consists of tables providing statewide and institutional data on business/industry relations.

Ironside, E., & Others. (1987). Corporations and colleges: Developing new potential and new purpose. (ERIC Reproduction Service No. ED 287 979).

The partnership of IBM, located in Research Triangle Park, North Carolina, and Meredith College, a small women's college, resulted in the secretarial transition training program.

Hiring constraints had created critical shortages in the secretarial skill field. Additional impetus for the development of a transition training program was provided by IBM's full employment practices.

When IBM identified surplus manufacturing and materials distribution employees, the corporation made these employees available for placement in other jobs, including entry-level secretarial positions.

Two instructors of the Meredith college were responsible for the major portion of the curriculum of the program, which was conducted on IBM's premises for a period of 10 months.

IBM internal business education instructors handled the presentations on IBM systems. The 25 employees who were selected were placed in the program full time and relieved of their previous work assignments.

For the first three months students attended classes six hours per day. From the fourth month, program participants spent one week of each month in an internship assignment working with experienced secretaries.

Meredith college provided a learning environment that would ease the transition from assembly line to professional office. Its flexibility and sensitivity to adult students also allowed the college to be responsive to the need for changes in the program.

Johnson, L. (1984). The High-Technology Connection: Academic/ Industrial Cooperation for Economic Growth. ASHE-ERIC Higher Education Research Report No. 6. Washington, D.C.: Association for the Study of Higher Education.

The purpose of this report is to examine the high-technology connection in which academic institutions and industrial firms are joined in cooperative efforts to stimulate technological change, taking into consideration the major spheres of academic/industrial cooperation, the primary mechanisms of interaction, and some of the most emerging problems and opportunities.

What makes up the "High-Technology Connection?"

From the standpoint of economic development, the high-technology connection can be conceptualized in terms of three major areas of linkage: research and development, technology transfer, and human resource development. The human resource development is discussed here.

The human resource connection: It merits more examination than it has received so far. The supply of graduates in science and engineering and the availability of skilled technicians are already major concerns of technology-based industries (Joint Economic Committee, 1982), and it is estimated that the skills of nearly half of the work force may be obsolete by the year 2000. To meet its needs for workers, industry now spends from $10 billion to $30 billion annually on in-house training programs. This trend is not going to change, but authorities in the training field see great opportunities for an expanded academic role, contingent on willingness to adapt to industry's needs (Lynton, 1981).

- Mechanisms for linking academia with industry vary from regular degree offerings and industrial advisory committees to external degrees and programs that grant credit for noncollegiate learning. Sponsorship of continuing education courses and the cooperative education movement have grown dramatically.

- While four-year colleges and universities struggle with critical shortages of faculty in engineering and computer science, two-year institutions are trying to accommodate the new demands for technicians in advanced technology fields.

- Little statewide coordination of postsecondary education resources, specifically training and other needs related to technology, is apparent. Development strategies for the most part are lodged in departments of commerce or economic development.

Not many true "partnerships" exist in the fullest sense of joint planning and management or extensive interaction on many fronts, although some examples are emerging. Initiatives to bring all segments of the community together to address local and

regional economic needs may prove to be powerful incentives for stronger bonds.

The major mechanisms for cooperation in human resource development are: professional and technical degree programs, business/industry advisory committees, cooperative education, continuing education programs, extended degree programs, nontraditional credit programs, industrial adjunct faculty, and cooperative planning and program councils.

Knox, R., & Lorenzo, A. (1987). Service wars: The race to be the best in product service. MI: Macomb Community College. (ERIC Reproduction Service No. ED 282 603).

To meet the price and quality challenges of foreign manufacturers, U.S. industry has had to invest heavily in technology, incorporating it extensively into both the manufacturing process and product.

This trend, termed the "New Industrial Revolution" has created a new challenge, educating technicians to service these highly technical, micro-electronic, and computer-controlled products.

One model for meeting this challenge is being piloted by Chrysler Corporation at Macomb Community College (MCC) in Michigan to address the critical needs of chrysler dealers for highly skilled automotive service technicians.

The four-year Chrysler Dealer Apprentice Program (CAP) has the following unique features:

(1) both MCC and Chrysler participate in recruitment and student selection.

(2) during the 2 years of the program, the student goes to school for 2 months studying subjects specific to Chrysler's systems and basic automotive theory and practice, then goes to work at the dealership for the next 2 months to work under the guidance of an experienced technician on those systems studied at school.

(3) the technician is paid a stipend to check the student's work; the student is paid as part-time employee of the dealership.

(4) after graduation, the student becomes a full-time employee of the dealership for two years.

(5) CAP operates through a signed contract between the student and the sponsoring dealer.

(6) Chrysler and MCC are working together to redefine the content of a number of liberal arts associate degree requirements to make the courses more relevant to the automotive student.

(7) all participants in the program (Chrysler, MCC, the dealership, and the student), make specific contributions and commitments to the program.

Levy-Reiner, S., & Others. (1986). Strenthening the connection between campus and business. Washington, D.C.: Association of American Colleges (ERIC Reproduction Service No. ED 266 710).

The benefits of campus-business cooperation to undergraduate education is considered. Descriptions of programs at 11 colleges are provided, along with an essay by Ernest A. Lynton on the role of liberal arts in career preparation and employee education.

In addition to briefly describing the liberal arts courses focusing on business, the following programs/activities are discussed:

(1) Albion Colleges' Liberal Arts Program Professional Management.

(2) Concordia College at Moorhead's International Business Program.

(3) Gallaudet College's effort to educate employers and co-workers about hearing-impaired students.

(4) University of Houston, Clear Lake's involvement in economic development with regional corporate/industrial and government sectors.

(5) Loretto Heights College's Program in Business.

(6) University of Louisville's emphasis on the value of a liberal art education through its College-Business Cooperative Program.

(7) University of Missouri, Columbia's programs that stress ties between agriculture and business.

(8) University of New Hampshire's continuing education programs to respond to state needs.

(9) University of Puget Sounds Business Leadership Program, Scripps College's Corporate Training for Liberal Arts Women.

(10) Towson State University's efforts to solve business problems with mathematical models.

An annotated bibliography is included.

Ludwig, Terry, Crist, Donald G., & Shoup, Blanche (1984). Admiral corporation and carl sandburg community college score through JTPA. Galesburg, IL: Carl Sandburg Community College. (ERIC Document Reproduction Service No. ED 243 536).

This summarization describes the joining of Admiral Corporation, the Illinois Department of Commerce and Community Affairs (DCCA), the Illinois State Board of Education (ISBE), the area administrative entity for the Job Training Partnership Act (JPTA) and Carl Sandburg Community College and their efforts to provide training and jobs for unemployed workers in Galesburg, Illinois. With the existence in the last five years of high inflation rates, low employment rates and slow productivity growth rates in Illinois, closer cooperation between business/industry, education and government is essential.

Admiral Corporation of Galesburg, Illinois was planning an expansion which included the hiring of 500 employees and was contracted by a marketing team representing the Illinois Department of Commerce and Community Affairs to offer a number of economic development opportunities from local, state and federal sources. Carl Sandburg College representatives participated in the discussions and arranged to coordinate the training grant application. In addition, the members of the area enntity for the JTPA worked with Admiral to establish training programs and negotiate training costs. As a result of these joint activities, Admiral's expansion project was funded and 138 economically disadvantaged individuals were hired and trained by Admiral (Ludwig, 1984).

The above depicts a success story of a well planned project. This project would not have been successful without the development of a special relationship between the community college, economic development agencies, and business/industry. Carl Sandburg College, specifically, has worked dilligently in West Central Illinois to identify areas of strength with which to develop linkages between agencies that share a common cause for economic development and businesses. The authors (1984) point out that a "mindset" or attitude receptive to innovation and change that considers the needs of business and industry is of primary importance (p. 6).

As the result of several success stories similar to the one above, Governor Thompson will be using the community college as the local economic development resource for the future in the development of centers for business and industry and by making grants available through the Community College Board and the State Board of Education.

McIntyre, William A, Blankenstein, Ronald G. (1984). Critical student factors in successful partnership training: a case study. (ERIC Document Reproduction Service No. ED 241 752).

The authors thoroughly describe in this case study a job retraining program that has been implemented at New Hampshire Vocational-Technical College at Nashua for the company of Sanders Associates, Inc., and also refers to the apparent success of this partnership. The job retraining program is an Electronic Technician Training program.

The following will provide some background on both entities involved in this partnership. The New Hampshire Vocational Technical College is a two-year institution and has been involved with over 50 partnership training programs for eight years. Sanders Associates, Inc. is a rapidly growing electronics company with headquarters in Nashua.

The goal of the design of the Electronics Technician program was to take nontechnical employees of Sanders and retrain them as electronic technicians. This program is a 13-month program (720-hour program), and participants of the retraining program continue to work in the company full time. The time schedule of the training includes a four-day program that lasts four hours each day (3:00 p.m.-7:00 p.m.).

Abram (1982) comments that motivation is noted as an essential ingredient for student retention. The following methods were used in this partnership to increase student motivation and retention:

1. **Credit v. non-credit programming.** Thirty-eight semester credits were awarded to those students who successfully completed the Electronics Technician program.
2. **Cost v. shared cost v. no cost.** No cost was a great motivator to encourage entrance in the program. The shared cost concept refers to the employees commitment of their own time after 5:00 p.m. for courses.
3. **Generation v. stagnation.** Sanders encourages upward mobility by providing for advancement of participants to positions as Electronic Technician with increases in pay upon successful completion of the program.

How is this type of program evaluated? How are the students evaluated? How are the trainers evaluated? The trainers were evaluated by the company, the college, and the students. The program was evaluated by a gathering bimonthly of management of Sanders and the college in order to review areas of concern. Importantly, students were evaluated by operational personnel as well as trainers before, during and after each instructional component.

Finally, the following outlines the reasons for the "success" of this particular partnership and the potential success for many other relationships:

1. Existence of strong commitment to participating students.
2. Feedback from the students is significant. Feedback from the college to the industry needs to pass back and forth in order to have any relevance.
3. Effective communication is a central factor in sustaining student motivation and retention of the students.
4. Concerns for the students is a way of building success into a training program from the earliest planning to program conclusion (McIntyre & Blankenstein, 1984).

In conclusion, this case study provides an orderly design of a partnership between business and education that has been apparently successful. To date the 13-month program has been completed twice and the student retention rate was over 90 percent (McIntyre & Blenkenstein, 1984). The case study outlines in detail the creation of such a partnership from beginning to end.

Moser, Katherine & Seaman, Don. (1987). Implications for potential linkages between business-industry and higher education. Adult Education Quarterly, 37(4), 223-229.

One of the most rapidly expanding areas in adult education is continuing education in the workplace (Craig & Evers, 1981; Darkenwald, 1983; Peterfreund, 1982; Schuster, 1978). Darkenwald (1983) comments: "Clearly educational institutions play a prominent role in the continuing education of the nation's workforce through cooperation with business and industry" (p. 231). Because of the social, economic, and business changes occurring in corporate America, higher education institutions have the opportunity to provide a service that would be beneficial to both business and education sectors.

Both authors of this article work in the field of adult higher education in Texas, and they conducted a study to investigate the following questions:

1. What was the extent of industry's use of training resources during the three years: 1980, 1983, and 1986?
2. What were training managers' preferred training activities and sources?
3. How willing were managers to access various types of postsecondary institutions to provide training programs?

To answer these questions, a group of 522 individuals who functioned as training managers from September, 1983 through January, 1984 in the southwestern region of the U.S. were surveyed. The sample was chosen from a list of 2,000 trainers provided by the American Society of Training and Development. The survey itself was divided into four parts which requested information on job title, function, and location of respondent; the number of employees and the company type; the size and function of the training staff; and to what extent training managers would be willing to utilize higher education institutions for training. The overall response rate was 72 percent.

As a result of this study, the following findings are summarized below:

1. The largest amount of resources spent on training was spent by companies with 3,000 or more employees.
2. Fourteen out of fifteen company types spent more money on technical training than on professional development.
3. The only company type to spend more on professional development was Education.
4. Respondents preferred universities to offer workshops and seminars for professional development and no clear preference was indicated for technical training.
5. In regards to the idea of using postsecondary educational institutions to provide training program activities, the researchers discovered that the higher the training manager's educational level, the more likely the willingness to use universities to offer technical training.

Morse, S. (1984). Employee educational programs: Implications for industry and higher education. Washington, D.C.: Association for the Study of Higher Education. (ERIC Document Reproduction Service No. ED 258 501).

Current types of industry-sponsored educational programs, training facilities, and teaching and evaluation methods are described.

The history of education and training within the corporate world and the roles of the government and unions are traced. Factors that have limited college and industrial cooperation in employee education are also identified.

Four types of employee educational programs are covered:

(a) job and company-specific training offered in-house.

(b) trade seminars and professional meetings.

(c) tuition aid programs.

(d) credit courses and degree programs offered by businesses either independently or in cooperation with colleges.

Philosophies of educating for work are discussed, as are competency studies conducted by three organizations. Benefits of collaboration for the two sectors are identified.

For college, industry provides a source of students and an opportunity for faculty to better understand technological changes and skills needed by employees.

For industry, colleges offer facilities, faculty expertise, research findings, and structures for awarding credit degrees.

Issues that colleges and industry should consider deciding whether to work together in educating employees are outlined, as well as ways to identify each other's needs.

Nash, N. & Hawthorne, E. (1987). Formal recognition of Employer-Sponsored instruction: Conflict and collegiality in postsecondary education. ASHE-ERIC Higher Education Report No. 3. Washington, D.C.: Association for the Study of Higher Education.

The extensive education and training programs established and run by business and industry for their own employees are discussed.

The extent of corporate education is assessed with attention to cost, providers, curricula, methods of instruction, organizations, evaluation, and corporate colleges.

Cost: The magnitude of corporate spending on education - ranging from $2 billion annually to $20-40 billion annually, to $100 billion annually, to more recent estimates of $30 billion annually- becomes clearer when it is compared to spending for traditional higher education. Combined federal, state, and local expenditures for public higher education in 1980-81, were $31.4 billion. In 1985, all expenditures for postsecondary education were $94 billion, compared to $30 billion for formal employee education and $180 billion for informal, on-the-job employee training.

Providers: Education for employees is provided in a number of ways: directly by firms for their own employees, by outside consultants, at college- and university-based seminars and short courses for management-level executives. Corporations generally pay for their employees to participate in such courses, but they also reimburse employees for courses taken at colleges and universities. Corporations themselves, providing direct instruction to their employees, are the largest provider of corporate education.

Some of the education provided by firms for their employees is credit bearing; some is not. Courses taken under a tuition reimbursement plan are generally collegiate credit-bearing courses. Courses taken outside the firm may or may not offer credit. They are administered within workers' units rather than through personnel or other centralized offices, although the practice varies.

The preparation of corporate trainers has changed in recent years. Size of corporate training staffs has been increasing, with market growth in financial institutions and less dramatic change in industrial firms.

Curricula: The curricula of corporate education goes from remedial education to master's and doctoral degrees, and courses vary in length from one-time sessions to extensive programs. Some training programs last three to four weeks, while apprenticeship programs last two to four years. Other courses are equivalent in length to a college semester.

In-house courses can be divided into three basic types:

managerial, functional-technical, and basic remedial. Management development includes such courses as principles of management, management by objectives, and decision making. Functional-technical courses include production, sales, and computer literacy. Basic remedial education is: reading, writing, and arithmetic.

Outside and after-hours courses tend to include broader subject matter than in-house courses offered during working hours.

Management and supervisory training courses include such courses as communications, human relations, decision making, planning, and problem solving. Data processing courses also vary, consisting of technical, programming courses for personnel who use the system daily as well as courses in electronic data processing management for all levels of operational personnel. Many companies offer in-house courses in computer concepts for executives not directly involved in data processing.

Courses for managers and nonmanagers vary greatly. Courses for managers tend to be in areas such as employee relations, communications, wage and salary administration, equal employment opportunity/affirmative action, while courses for nonmanagers include an almost limitless number of subjects (from telephone courtesy and job skills specific to one industry, to accounting, engineering, instrumentation, and mechanics). Most courses are related to the job.

Methods of instruction: Although much corporate education is conducted using the traditional methods of lectures and discussions, the emphasis has been shifted to learning by doing. This shift is a logical extension of corporate complaint that universities lead too much to theory and are deficient on practice.

Almost all companies using in-house education for managers use lecture and discussion methods. Courses for nonmanagers tend to use hands-on methods, following the early tradition of apprenticeship programs.

Many companies use role playing to teach courses in interpersonal skills, particularly to bank tellers, salesmen, and clerical personnel who interact with public. Managers are taught how to interact with minorities and women to avoid discrimination.

Programmed instruction is another method. It allows students to go through the course at their own pace and also lets the instructors have more time to deal with problems. Programmed instruction often uses books, audio equipment, and computers.

Organization: Companies use sophisticated organizational structures to provide their training programs.

Some large firms have separate education divisions, while

small firms employ only a single trainer. In most firms, education and training are part of the human resource development/personnel units. Also, more firms are including training in line managers' responsibilities.

Evaluation: Some firms spend little time evaluating in-house programs. Some firms, however, are actively involved in evaluation. It is informal, but more formal efforts include questionnaires, pre- and post-test of performance/knowledge, interviews, and supervisors' evaluations of effectiveness of the courses.

More recently, evaluating outcomes has been more seriously taken and different evaluation models have been applied.

How findings are used in a firm affects participation in later evaluations. Ten uses are common:

- to provide feedback to decision makers
- to improve training program
- to provide feedback to participants
- to gain knowledge of employees' skill levels
- to build status and prestige for the training unit
- to study employees' effectiveness
- to analyze costs
- to identify future leaders of the organization
- to gain information for performance analysis
- to place employees in units where they will be most beneficial to the organization's goals.

Corporate Colleges: Generally corporations have not been granting degrees, leaving credit- and degree-granting authority to colleges and universities. In some instances, since corporations have not been getting what they needed from colleges and universities, they have founded corporate colleges.

A corporate college is an institution offering postsecondary degrees that was initially established by a nondenominational entity, for profit or nonprofit, whose main mission was something other than granting college degrees. The primary interest continues to be in employers' creating colleges to develop, maintain, or upgrade their own employees' skills, even when nonemployees are allowed to enroll. The degree-granting characteristic moves corporate education out of a purely private arena into a public one.

Corporate colleges can be divided into those which were established as nonprofit educational endeavors, those established as for-profit educational enterprises, and those that were purchased as for-profit educational endeavors.

At present, 21 corporate colleges in 11 states have degree-granting authority. Almost all began by offering programs in specifically defined fields. Corporate colleges tend toward graduate or first professional degrees.

Corporate colleges expect their education to have more immediate benefit than many traditional colleges do, and this expectation influences their methods of instruction.

Flexibility: Many corporate colleges have the same schedule as traditional education. Some of them, however, offer a more flexible schedule.

Corporate colleges do not differ from traditional institutions of higher education in their faculty or requirements. The fact that so many of them have received accreditation testifies to their comparability to traditional colleges. Besides, all of them have received degree-granting authority. Where corporate colleges differ from traditional education is the narrowness of their missions.

Corporate colleges tend to hire more part-time faculty than traditional universities. They let faculty members stay updated in their fields with their emphasis on technological currency and hands-on experience.

The absence of departmentalism and tenure means that corporate colleges are better able to change curricula and requirements. Thus, corporate colleges find it easier to stay on the cutting edge of technology than do traditional colleges.

An important factor that influences the growth of corporate colleges is the growth of technology.

Powers, D. Powers, M. Betz, F., & Aslanian, C. (1988). Higher education in partnership with industry. San Francisco, London: Jossey-Bass Publishers.

PART ONE

MAKING PARTNERSHIPS WORK: OBJECTIVES, APPROACHES, AND STRATEGIES.

The two key types of programs that are the basis for business-higher education partnerships are: cooperative education and training programs and cooperative research programs. This chapter discusses the cooperative education and training programs.

Cooperative Education and Training Programs.

Colleges and universities are by no means an educational monopoly. Training-vendor companies and industrial training departments of large businesses offer hundreds of thousands of courses every year.

Although Eurich noted that businesses spend massive amounts each year to produce education and training programs for their employees, she claimed ("Business and Higher Education Report", 1985) that corporate colleges do not pose a threat to higher education.

Most businesses find it cost effective and productive to enter into relationships with colleges and universities to obtain needed services. Courses can be offered on campuses or at corporate locations; on a credit or noncredit basis; as part of associate, undergraduate or graduate degree programs; or as part of non-degree enrichment or continuing education series. Payment can be according to a standard fee or according to contract. Tuition may be paid directly by employers or by students who are entirely or partially reimbursed by their employer companies.

Example of some of the subjects in demand range from nuts-and-bolts courses in office automation, computer assisted design, spreadsheet applications for accounting, and servicing electronic equipment offered by two-year technical or community colleges; to state-of-the-art seminars in computer software design and computer-integrated manufacturing offered by schools of engineering; to courses in modern management techniques provided by graduate schools of business and public administration; to professional updating courses offered by schools of social work, law, health professions, and education among the innovative courses offered by some universities.

Need for updating and retraining. Other factors more far reaching than employee satisfaction or human resources investment have given rise to concern among workers, business people, educators, and government officials that more effective means of updating and retraining the country's work force must be provided. These factors include demographic changes, rapid advances in technology, the shift to an automated manufacturing

and services-based economy, and the need to compete in international markets. At state and regional levels, concern is to attract and retain businesses and jobs and to improve tax bases.

What can be done by higher education in response to this situation? Powell (1984) provided a succinct response: "Three major categories of activities emerge: Updating American schools through better training and retraining for teachers and a reassessment of school curriculum; updating the American work force through continuing education and retraining; and updating the American economy through research and development, basic and applied research for invention in new technologies, increases in productivity, improvements in management, and enhancements in quality. Higher education should position itself as a major technological resource for assisting in these tasks. The once distinct roles of teaching, research, and public service are merging. No longer will education be able to isolate its primary functions of teaching and research from its community role, public service".

What constitutes a better educated population in view of the technological change that is deeply affecting business and industry? Ammon and Robertson (1985) reported a Michigan survey conducted in 1984 by the Emerging Technology Consortium of four Michigan community colleges. The survey revealed that employers were concerned with three levels of basic skills: (1) fundamental work attitude and behavior, (2) competency in language and computation, and (3) technical literacy relating to manufacturing.

Jaschick (1986) in the Chronicle of Higher Education, reported that the problem colleges face in meeting those needs necessitate the following:

- Experienced instructors who are not academic but are employed in industry.
- State-of-the-art equipment, which is often expensive.
- Expanded state support to include the non-degree programs and courses needed by businesses.
- Partnerships with developing companies that create the most jobs.

Innovative Training and Education Programs. Innovative community college-based programs that address emerging technologies are being sponsored in partnership with business, state government agencies, and unions. Such partnerships represent a closer working relationship among these very different organizations for common advantage. The following are some examples:

1- Keeping America Working (KAW) activities: The American Association of Community and Junior Colleges/Association of College Trustees' Keeping America Working project is involved in a number of human resource development activities, the best known

of which is the Partnership Development Fund. This activity is used to provide minigrants to encourage partnerships among colleges and employers, labor unions, and high schools.

2- AT&T Retraining Institute: The purpose of the institute is to help workers who face displacement or dislocation find different jobs. Workers receive career counseling and retraining through two-year or four-year colleges.

3- Automotive Service Educational Program: This program, sponsored by General Motors, is a consortium to meet a single employer's training needs.

General Motors had found it too expensive to meet its growing training needs by continuing to build classrooms and hire instructors; instead, it approached community colleges that had available classrooms and instructors and were anxious to improve the technical expertise of their faculties and obtain up-to-date training equipment. In some cases, colleges agreed to provide instructors to existing GM training centers; in others, special GM classrooms were established at colleges and staffed by college faculty.

4- State-sponsored programs: A number of states sponsor programs or units to maximize technology training opportunities. For example, South Carolina's Center for Innovative Training in Microelectronics, The Advanced Technology Center at Lorain County Community College in northeastern Ohio.

In Illinois, four programs were started between 1982 and 1986 to help community colleges provide job training for businesses (Jaschik, 1986): (1) High-Impact Training Services Program, (2) Industrial Training Program, (3) Prairie State 2000 Authority, and (4) Economic Development Grant Program.

5- Quality/Productivity Training Network: Two national associations, the American Association of Community and Junior Colleges (AACJC) and the American Society for Product Control (ASPC), established the Quality/Productivity Training Network, which links AACJC's 945 member institutions and ASQC's 200 sections (including 42,000 individuals and 400 corporate members). The purposes of this nationwide communication network are to share quality-control and productivity training resources and case histories; develop training programs to help businesses improve quality control and productivity; and expand training resources by disseminating knowledge, materials, and approaches.

Federal Role in Meeting Education and Training Needs. The federal government has accepted responsibility to pay part of the costs of job training for unemployed and dislocated workers in economically disadvantaged regions. Three examples deserve special comment:

1-Job Training Partnership Act: In 1982, this act was created. Certain programs named in the act are meant to be

operated by the states, with costs matched on a fifty-fifty basis (National Alliance of Business, n.d.). The act requires wide participation by local governments and businesses in a way that ensures shared decision making.

2- Cooperative Education: Formal agreements that enable students to work part time and go to school part time constitute a well-established type of partnership between higher education and industry. Federal matching funds to support those agreements are available through programs begun in 1970. The fact that matching funds are involved encourages colleges to accept responsibility for coordination with companies that participate.

3- Federal vocational education funds: According to the Office of Vocational and Adult Education (1985), hundreds of millions are allocated to the states each year under matching-fund grants designed to upgrade and update vocational education training offered by the states. Most funds are given to public education to buy equipment and pay salaries of instructors in vocational-technical centers. An important goal of vocational education programs is to train individuals for the private sector employment.

Powers, D. Powers, M., Betz, F., & Aslanian, C. (1988). Higher education in partnership with industry. San Franxisco, London: Jossey-Basss Publishers.

PART TWO: PARTNERSHIPS FOR TRAINING: PUTTING PRINCIPLES INTO ACTION.

Providing contract training to organizations.

Contract training refers to an arrangement in which organizations, whether a business, a government agency, or a voluntary association, contracts directly with a college for instruction of its employee, its clients, or its members.

Why is contract training needed? The demand for training is predicted to increase, so contractual arrangements with employers will provide a more fruitful area of development for colleges. Automation of work and other changes in technology, foreign competition, economic pressures of inflation and unemployment, changing attitudes and expectations toward work and careers, and continuing government regulations of employment practices force businesses to seek new and creative ways to respond to this problems to ensure their own survival.

Although some colleges have responded to this demand, many have not. Lack of collegiate respond had led some major corporations to develop costly, complex, in-house training departments; to seek private sector training companies or outside consultants to provide nonacademic training for their employees; or even to create corporate colleges, fully accredited, degree-awarding institutions.

Why is to the advantage of organizations to look outward instead of inward for the kinds of training and education assistance, support, and skills they need for their employees? First, the particular kind of expertise required may not be available internally. Second, duplication of services and facilities usually is not cost effective. College campuses can provide facilities at minimal charge to companies. Hiring teachers to form large training departments within companies is a costly venture that bites into profits. Although most colleges cannot compete with some companies in providing expertise in certain high-technology fields, higher education still prevails as the seat of learning and innovation in many areas.

Advantages of contract training: The advantage of contract training cannot be defined. Compared to traditional education, it gives students convenient times and places to study, less worries about finances, clearer understanding of the connections between theory and applications, greater contacts with other students that share the same career objectives, more chances to practice classroom skills on the job, less concerns about jobs after graduation, greater ease in updating skills throughout their careers, and greater access to instructors who are current in

their fields.

Further, fostering good ties with organizations can benefit a college in other ways through financial support, talent, and opportunities for teachers to put the theory into practice using real-life conditions. In fact, all of the types of possible alliances between colleges and organizations could develop out of a training-by-contract relationship, including research and development projects; sharing of facilities and staff; and internships, apprenticeships, and opportunity for work-study programs.

What should be done? Colleges will have to be aggressive in seeking out businesses and organizations, studying companies needs, adjusting the content of their curriculum, modifying their time schedules, and teaching exceedingly well to show job-related results. They will have those instructors who are best qualified to teach, not drawn necessarily from the faculty or with the usual academic credentials. They will have to recruit from the military, the government, professional associations, consulting firms, Research and development labs, companies, the retired, and other nations. (Brickell and Aslanian, 1981).

Organizations have to be ready to face changes in order to be able to survive. Those that will survive will be those that invest in creative thinking, in new methods in training, and in engaging their employees in new experiences. Survival will mean flexibility, change and learning.

Scott, R. (1987). The $40 billion question: Who will train for the corporate future?. (ERIC Reproduction Service No. ED 288 447).

Corporate education and its challenge to traditional higher education institutions are discussed.

Two of the four basic missions of advanced education are the same at corporations and colleges: research and training.

Educational programs offered by corporations range from the remedial to the doctoral and include educational skills development, general education, professional training, and advanced instruction in scientific and management studies.

It is noted that corporations must contract for educational programs and colleges can provide business with educational programs at less fixed cost and higher quality. There are three models of relationships that colleges and universities can undertake:

(1) straight contract,
(2) joint ventures, and
(3) quid pro quo.

It is concluded that colleges are realizing that they have not been meeting the needs of corporate employers for education and training. For example, colleges do not want to arrange the classes schedule to the employees' convenience. Colleges also recognize that the market of 18- to 22-year-olds is declining, while employees seeking continuing education is an expanding market. On the other hand, it is suggested that the commitment to education is not universally sustained by corporations.

Suchoraski, J. (1987). Contract training in community colleges. (ERIC Reproduction Service No. ED 291 425).

One of the most significant developments in higher education over the past decade has been the increased linkages between colleges and other organizations and institutions. A promise and fast-growing form of linkage is contract training.

Contract training refers to an arrangement in which business, a government agency, or a community association contracts directly with a college for the provision of instruction to its employees, clients, or its members.

Contract training can generally be clustered around several areas of activity:

- apprenticeship training
- community- wide collaboration
- community-based education
- contract services for industry
- economic development services
- Job Training Partnership Act programs
- faculty "return to industry" programs
- program development sharing
- specialized programs.

This review of community college contract training covers the following topics:

(a) organization for delivery and extent of involvement

(b) types of training and current patterns

(c) problems and barriers to the full utilization of community college resources by industry

(d) benefits

(e) trends and predominant models

(f) elements of successful programs.

The next part of the report offers a case study of contract training at Santa Fe Community College (New Mexico), covering the same areas.

The final sections examine policy issues, discuss implications for increasing participation, and offer conclusions.

ENTREPRENEURIAL DEVELOPMENT RELATIONSHIPS

American Association of Community and Junior Colleges, Washington, D.C. Council for Occupational Education. (1986). Community colleges and economic development. National Council for Occupational Education Monograph Series, Volume II, Number 3. (ERIC Reproduction Service No. ED 278 441).

A study was conducted by the National Council for Occupational Education to measure the extent to which community, junior, and technical colleges were engaged in economic development activities.

A questionnaire was mailed to 1,144 colleges in March and April of 1986, requesting information on the types of economic development activities performed by colleges and how important these activities were perceived to be.

Study findings, based on 37.80% response rate, included the following:

(1) 52% of the respondents stated that their colleges evaluated their economic development activities and 86% publicized their involvement.

(2) 40% had developed and published their mission statements referencing economic development.

(3) 35% reported the existence of a policy and procedures for economic development.

(4) 47% had designated economic development specialists and 77% encouraged faculty members to be involved in economic development.

(5) 95% had established linkages with economic development agencies.

(6) 70% provided "quick start" training for employees of new and expanding businesses and industries.

The survey instrument and detailed findings are appended.

Antonini, Joseph E. (1987). Partnership between business and education. Chain Store Age, General Merchandise Trends, 63, 16-17.

This article is written by the chairman, president/CEO of a major retail chain, and he records his observations and understandings of an apparent long-time need for formal partnerships between business and education. The following summarizes "recommendations" for a successful and profitable cooperation between a business and educational institution. In addition, a Presidential commission asked a group of businessmen in 1984 to suggest ways in which the nation's business schools could contribute to the revitalization of the American economy. Their recommendations are also recorded in the following.

1. There needs to exist competence in oral and interpersonal communication between business and education. Business and education do not talk together often enough and in the same language.

2. An important recommendation by the commission is to encourage business schools and their parent university to be alert to new opportunities for joint ventures with the corporate community. These joint ventures can provide expertise and the resources necessary to inspire new knowledge in fields such as information management. Take the time to learn about each other's needs.

In conclusion, the author applauds universities' efforts in making business education coursework/programs more relevant to today's world. He (1987) uses Central Michigan University as an example of their "real world" efforts in the design of a Center for Creative Business Studies for business community outreach and a Retail/Service Center (p. 17).

Deady, J., & White, W. (1987). A response for factory closings: A career development approach. (ERIC Reproduction Service No. ED 291 982).

This report describes the Career Planning Center, formerly the Institute for Vocational Readiness program, run by the Student Services Division of the Milwaukee Area Technical College.

It briefly describes services offered by the center which are focused around a comprehensive diagnostic approach, offering students help in developing a positive self-image, reviewing interests and aptitudes, learning how to develop a career ladder, role playing, practicing job interviews, learning about career options, planning remedial programs, or preparing financial work.

The involvement of the Career Planning Center with industry and business in the area is explained in detail and the Center's effort to provide industrial and technical assistance are discussed.

In-plant training classes range from instruction in basic reading and mathematics through computer programming which serve to assist employees destined for layoff to be upgraded in their skills so they can bid on jobs opening up in other departments of the company. Other courses are Psychology, Economics, Languages, Psychology of Human Relations.

Components of the Center's on-site Career Planning seminars include: assessment, intake, administration of an interest inventory, basic skills assessment, and group or individualized options once the program is over.

The objectives of the seminar are:

(1) to help clients to understand the components of a typical career planning process.

(2) to help clients to understand a career plan and then, to begin to implement this plan.

(3) to help clients in the development of a personal assessment, which would include the basic educational abilities, interests, values, and either measured or self-assessed skills.

(4) to familiarize clients with the components of a typical job search campaign.

(5) to offer clients career information and basic evaluation results which could enable them to understand their option.

Fenwick, Dorothy C., Giorgio, P. Anthony, Kopecky, Robert J., Lloyd, Lawrence G. & Myers, James R. (1986). Guide to campus-business linkage programs. New York, New York: Macmillan Publishing Company.

Higher education institutions and private industries are becoming more interdependent. This review will provide valuable information concerning the predevelopment, development, and postdevelopment phase of establishing formal campus/business linkage relationships.

Predevelopment Phase

Much thought and planning must go into this initial phase, and the following questions must be answered: Who initiates a campus-business linkage, why initiate this type of relationship, where should a campus-business linkage office be strategically placed, how will the external environment be evaluated, and is it cost effective.

A linkage program may be initiated by the President of an institution, Vice President for Academic Affairs, the Faculty Senate, the Board of Trustees or a particular Dean of Instruction. The real concern lies not with who initiates campus-business linkages but how much power the initiator has (either financial, political or personal). Fenwick, Giorgio, Kopecky, Lloyd and Myers point out (1986) that without a major commitment from a powerful individual or group, linkage programs are doomed. This type of linkage should become an integral part of the institution's mission, and information pertaining to this relationship must circulate among administration, faculty and staff of the institution in order to ensure a broad support base.

The reasoning for the initiation of campus-business linkages (CBL's) involves internal as well as external purposes. The following itemizes internal as well as external reasons for the development of this particular kind of relationship:

1. Desire for new income sources, both in tuition and development dollars;
2. Interest in the expansion of educational opportunities for nontraditional students;
3. Innovative curriculum development by faculty;
4. Desire to expand communication network between academic and business communities;
5. Desire to change image of institution in community it serves;
6. Faculty and staff development through exposure to new environments and challenges;
7. Real or anticipated change in the economic development of the community;
8. Training demands from private businesses. (p. 5 & 6)

Another question to be answered during the predevelopment phase is where a CBL office should be placed, and the second part of this

question is where this office will lie in the institution's organization structure. The significance of the placement of this office in the higher education institution will affect the credibility, efficiency, productivity and visibility of the campus-business linkage.

Furthermore, when contemplating the development of a CBL, the institution must secure an accurate picture of the external environment. The external environment represents the marketplace for a linkage program, and the market potential, competition and cost effectiveness must be taken into account. Determining the cost effectiveness is regarded by the authors (1986) as the most difficult task during the predevelopment phase.

Development or Construction Phase

This phase involves specifically four essential components: program construction, curriculum development, program implementation, and program evaluation.

Program construction consists of the decision-making process that determines the design and nature of the program. Before a draft of a linkage program is written, the audience must be identified, program goals established, consensus secured on selection and involvement of appropriate people, and necessary resources, costs and deadlines identified. In addition, when designing a CBL program, a decision needs to be made in regards to the type of program offered, whether it will be contract vs. open-market classes, college credit vs. noncollege credit, on-site vs. on-campus instruction, or training vs. education. Also, a tentative agreement needs to be reached as to which resources the institution will provide and which resources the business will provide.

Fenwick, et al. (1986) emphasizes the importance of an actual "construction meeting" for the sole purpose of gathering information needed to make necessary decisions and the bringing together of the individuals involved in this process, such as the CBL coordinator from the institution and human resource specialist from the business. Both groups involved should be given an opportunity to identify their needs and the necessary resources required to satisfy those needs.

Following the program construction, development of the curriculum must be detailed according to content and learning experiences. Quality, delivery and evaluation also must be taken into account. Active involvement of the business in this entire process is of the utmost importance. Specific objectives, concepts to be learned and skills to be mastered, as well as the evaluation of the learner must all be identified.

When the point in time has arrived to implement the linkage program, a contract must be written and signed by both participating entities. A successful implementation process includes the acquisition of appropriate equipment, visitation of

facility site, obtain necessary instructional materials, identification of special staff assignments as required, maintenance of lines of communication, preparation of public relations materials, involvement of faculty in the decision-making process as well as the monitoring process, and evaluation of the program by appropriate institution's administrators, faculty, students and employers.

Postdevelopment Phase

Tasks involved in the postdevelopment phase include:

1. Implementation of follow-up activities for ongoing programs
2. Promotion of the CBL in the marketplace
3. Fostering commitment and support for the CBL and to promote the CBL as a permanent concept in the institution (p. 48).

In conclusion, this text provides a vast wealth of information and covers all avenues that are necessary in order to design, implement and promote effective campus-business linkage efforts.

Illinois Community College Board, Springfield. (1987). Fiscal year 1987 economic development grand report. Springfield IL: Illinois State Dept. of Commerce Community Affairs. (ERIC Reproduction Service No. ED 290521).

A profile is provided of Illinois Community Colleges business centers and activities they conducted under fiscal year 1987's $3,730,376 economic development allocation.

First, highlights of the year's accomplishments are presented, indicating that:

(1) community colleges provided customized job training for 1,395 companies through 1,954 courses, serving 37,227 employees.

(2) over 3,200 businesses were assisted in seeking federal contracts, yielding over $66 million in contracts.

(3) over 30,000 potential and existing business people served through entrepreneurship training and services.

(4) nearly 23,000 persons received employment training to improve their job skills and assist them in seeking employment.

(5) 14 community colleges were involved in helping to establish or operate small business incubators.

(6) more districts were involved in industrial retention, expansion, and attraction efforts which contributed to the retention of 43 firms and the start-up and the expansion of 124 firms.

Next, background information is presented on the community colleges' involvement in economic development.

The next sections provide data on economic development grant use by activity; jobs created or retained with the assistance of community colleges; and other funds budgeted for economic development.

The primary economic development activities undertaken by colleges are discussed, including industrial attraction, retention, and expansion; customized job training; entrepreneurship training; contract procurement; small business incubators; and services for unemployed or underemployed people.

Johnson Community College (Overland Park, KS), Office of Business and Industry Liaison, and Office of Institutional Research. (1983). Johnson county business and industry training needs. Overland Park, KS: Office of Institutional Research. (ERIC Document Reproduction Service No. ED 245 711).

The following describes a case study wherein Johnson County Community College in Overland Park, Kansas conducted a study to determine training needs of business and industry in Johnson County. This study was performed in the Fall of 1982, and commenced with the mailings of two separate surveys.

The study population included 2,000 businesses and industries in the Overland Park region and 2,000 employees of a large corporation in Johnson County, Kansas. One survey was mailed to chief executives of 2,000 businesses and industries, and the other survey was distributed to the 2,000 employees of a large corporation in Johnson County.

Responses were received from 260 companies and 505 employees. The types of companies responding included wholesale trade, financial services, insurance, business services, real estate, retail trade, health services, hospitality services and manufacturing.

The following outlines the findings from both surveys:

1. Skill areas where the greatest unmet training needs exist are in the areas of human relations, management/supervision, time management, stress management, and communication.

2. Short-term workshops and seminars were the types of training programs of greatest interest to all company types.

3. Employers were more interested in general skills development training, while employees were primarily interested in specific and practical skills that are job related and provided opportunities for promotion.

4. College credit courses were not identified as a major concern in the delivery of training.

5. Larger companies were more interested in training programs at the business site, and smaller companies were more interested in training on the Johnson County Community College campus.

6. Evenings was the preferred time for training for all companies; however, companies requesting contact with Johnson County Community College were more interested in programs during work hours and on weekends.

In order for community colleges to assist their regions in the economic development realm, a good foundation or relationship needs to be nurtured with companies in order to determine unmet training needs of the region's companies.

Johnson, L. (1984). The High-Technology Connection: Academic/ Industrial Cooperation for Economic Growth. ASHE-ERIC Higher Education Research Report No. 6. Washington, D.C.: Association for the Study of Higher Education.

The purpose of this report is to examine the high-technology connection in which academic institutions and industrial firms are joined in cooperative efforts to simulate technological change, taking into consideration the major spheres of academic/industrial cooperation, the primary mechanisms of interaction, and some of the most emerging problems and opportunities.

What makes up the "High-Technology Connection?"

From the standpoint of economic development, the high-technology connection can be conceptualized in terms of three major areas of linkage: research and development, technology transfer, and human resource development. The technology transfer connection is discussed here.

Cooperation in technology transfer. The emergence of new concepts in science and engineering is only one part of the process of innovation. Analysis of innovation as it occurs in established corporations and in new firms reveals that numerous factors should be taken into account, including the costs and risks associated with research and development, the organizational practices of the corporation, the role of the entrepreneur as product champion or as head of a new firm, and the needs of small businesses for technical, managerial, and financial assistance.

- Transfer of technology occurs through such means as informational events and publications, faculty consulting, associates programs, and various kinds of extension services.
- Industrial or research parks require the right mix of circumstances to succeed. A variation that is becoming more popular is the industrial incubator that helps small firms in their initial phase.
- Efforts to support entrepreneurship often entail close cooperation with a number of industrial and community growth organizations in a particular area. The term "cooperative entrepreneurial development" describes these comprehensive programs.

Cooperative mechanisms for technology transfer.

The classification of these mechanisms is less standardized than for cooperative research models. Although definitions vary, the major mechanisms for technology transfer are:

(a) Seminars, speakers, and publications. Most academic departments in science and engineering have information services through conferences, speakers programs, and publications, especially for centers and institutes with a specific research

focus and with interest in advertising their programs. Corporations and industrial societies may also sponsor such activities.

(b) Consulting relationships. Faculty consulting is very important for the application of knowledge to problems in the industrial sector.

Reasons for promoting this type of link with industry may include supplementing faculty income, attracting research contracts, or maintaining a communication network (Peters and Fusfeld, 1983).

(c) Industrial associates programs. Alternately called "liaison" or "affiliates" programs, these efforts help create a stable base of industrial support for academic research and provide participating companies with the academics.

(d) Extension services. This type of mechanism consists of linking the university-based technology centers to federal programs to assist small companies (Baer, 1980).

Small business development centers (SBDCs) and innovation centers have many common characteristics as extension services. The first one tends to focus on managerial problems of small business in general, while the second one tends to focus on entrepreneurial problems.

SBDCs have been established at many academic institutions and they offer consultation services as well as continuing education.

(e) Industrial incubators and parks. A number of academic institutions were interested in closer links with industry, so they have participated in arrangements to provide physical facilities for companies. The two major forms are industrial incubators and industrial parks.

The objective of industrial incubators is to provide an interactive environment between industry and higher education (Venture Capital Journal, 1983). They are located very close to an institution and access to faculty consultants, equipment, library, computer facilities are very helpful.

A park site close to an university makes it easier for academic and industrial researchers to interact and develop cooperative programs.

(f) Cooperative entrepreneurial development. This term is referred here to reflect a more comprehensive approach to promoting the transfer of technology and the development of entrepreneurship through a broad range of cooperative activities focused on the community or region.

One type of activity related to entrepreneurial development

is called "technology brokering". The broker brings universities with research capabilities together with industrial firms with research needs (Baer, 1977).

Kapfer, M. (1988). Making the partnerships work through a business and industry center. (ERIC Reproduction Service No. ED 293 601).

In response to economic hardships affecting agriculture, small business, and manufacturing in Iowa, the Eastern Iowa Community College District (EICCD) initiated an economic development strategy aimed at the expansion of the employment base, diversification, assistance to existing businesses to increase their markets, and entrepreneurship.

Spurred by tax-credit incentives provided by the Iowa Industrial New Jobs Training Program (IINJTP), 21 companies have already entered into job training agreements with EICCD, and nine more companies are expected to formalize agreements.

The IINJTP provides companies with screening and recruitment of potential employees, pre-employment training, and on-the-job training. Other aspects of EICCD's economic development strategy include:

(a) a Small Business Development Center, which offers new and existing businesses and entrepreneurs one-on-one counseling, classes and workshops, and reference materials.

(b) a formalized program to develop international trade through seminars and one-on-one consultation with international trade specialists.

(c) a database of products and services of companies throughout Iowa to assist businesses in finding new markets.

(d) the Eastern Iowa Procurement Assistance Center, which helps small businesses obtain government contracts.

Keedy, H. (1983). Are academia and industry thinking alike: Does the right hand know what the left hand is doing? (ERIC Reproduction Service No. ED 239 282).

Many companies feel that the communication skills of newly graduated employees are inadequate. As a result, they try to improve employee communication skills by either encouraging extension type courses, establishing in-house instruction, or retraining consultants to give individual tutoring or group workshops. While each of these approaches is effective to an extent, none of them is a cure-all.

Though well aware that graduates should be useful to employers, academia is often hindered in its efforts to improve student communication skills.

Academia and industry can help each other to reduce communication problems with:

(a) summer work opportunities in which faculty learn of company needs while helping employees improve their writing skills,

(b) more technical communication texts with examples of actual business communication situations,

(c) instructional modules on teaching writing to technical students,

(d) industry initiatives providing students with opportunities to develop or revise documents,

(e) faculty development programs on helping students to learn on "how to cope", and

(f) consortia of industrial firms and academic institutions to identify the firms' communication needs and determine how they can be met, through education or training avenues.

Windler, D.R. & Topping, J.J. (1988). Industrial and academic partnership board: towson state university, college of natural and mathematical sciences. Unpublished manuscript.

The purpose of this summary is to review the establishment and mission of the Industrial and Academic Partnership Board which was conceived in 1984 at Towson State University, Towson, Maryland. Towson State educates professional scientists and provides background in science to students majoring in non-scientific fields.

Mission

The sole purpose of this partnership board is to provide a mechanism at Towson State for communication between the College of Natural and Mathematical Sciences and the local industrial community. This partnership serves as a formal and necessary link between the College and the local business, industrial and governmental community surrounding Towson State, and this linkage is recognized as an essential element in the College's growth.

Historical Background: Why Was This Partnership Conceived?

In 1982, Dr. Robert Caret, then Dean of the College of Natural and Mathematical Sciences, foresaw the need for his college to have a more effective and promising relationship with business and industry. As a result of this need, the Industrial Outreach Committee was formed. Members of the committee represented persons from each academic department of the College. This committee then made the decision to form an Academic-Industrial Advisory Council which included five corporate representatives. In 1984, the Advisory Council was announced with specific goals identified. These goals included the following: to promote coordination of industrial research and consulting activities; improve communication between the College and business, industry and government; coordinate short courses, workshops, and seminars for the community; and to facilitate grants, endowments, equipment acquisitions and maintenance beneficial to the College and the external community. The Advisory Council later changed its name to the Industrial and Academic Partnership Board.

Members of the Partnership Board include the Dean of the College, Chairs of the five academic departments, the College's Grants Coordinator, the College's Industrial Outreach Coordinator, and representatives from entities of business, industry and government, such as AAI Corporation, AT&T, Black & Decker Corp., Blue Cross/Blue Shield, Citicorp/Citibank, Westinghouse Electric and Martin Marietta Laboratories, to name a few.

Benefits for corporations to supply representatives to serve on this Partnership Board include the following:

1. Networking ties w/area businesses

2. Exposure for company to academic community
3. Articulation of educational needs
4. Expert ideas and outlooks through faculty "business sabbaticals" and student internship programs and cooperative education programs
5. Provision of an increased tax base within Towson community by retaining graduates within Maryland
6. Providing an attractive environment for relocating or transferring employees into Maryland by provision of access to local higher education opportunities and facilities
7. Provision of access and advice about computer programming assistance and facilities. (Windler & Topping, 1988)

In conclusion, colleges and universities which have identified a similar need as Towson State to establish a type of business/academic partnership board, may refer to this pattern and formulate such a cooperative effort for their respective institution. It appears to be significant to point out that a strong cooperative effort must lie both with the educational institution and the business community in order for both to profit from the partnership.